The clean version of pending claim 9 to replace the prior version

[Note] This is the clean version of pending claim 9 to replace the prior version presented in the pre-amendment B, in which only

(1) the phrase "or the like" has been deleted (see page 10, last line of the pre-amendment B), and

(2) some words which were overtyped with others to be replaced by "--- laser medium means ---" (see the sixth line from the bottom of page 12 of the pre-amendment B).

9. (new) In a method in constructing a multipass pump head for DPSS lasers, fiber lasers and fiber amplifiers, capable of realizing intense uniform pumping and producing and amplifying coherent light, comprising the steps of

A. selecting a pump source means, from the group consisting of a diode bar means and a multiple-pump-source means having a single pump wavelength or multiple pump wavelengths, to provide a relevant pumping light for pumping;

B. selecting a laser medium means from the group including

(1) laser chips, laser rods and laser slabs, made from regular laser materials or tunable laser materials, and

(2) optical fibers with a rare-earth-doped core;

C. setting a coupling manner to couple said pumping light to a pump entrance means including at least one pump entrance for the input of said pumping light into said multipass pump head; and

D. constructing said multipass pump head by use of a multipass formation to confine said pumping light, wherein said pumping light, once entering, undergoes multiple reflections and multiple travels through or within said laser medium means, said multipass formation is selected from the group consisting of

(1) a first multipass formation with the use of optical total-internal-reflection configuration, which additionally comprises the steps of making said multipass pump head as a TIR-guide pump head by mean of an optical duct means, leading to confining said pumping light within said TIR-guide pump head mainly via total-internal-reflection during the entire pumping process; wherein i) said pumping light, once entering said pump head and said optical duct means, will undergo zig-zag optical paths, multiple reflections and multiple travels through or within said laser medium means until it is absorbed, and ii) the escape loss possibility of unabsorbed said pumping light is at least less than 40% within one round trip pumping path, or at least less than 40% during the entire pumping process; whereby i) significantly reducing multiple reflection losses caused by the zig-zag optical paths, ii) confining said pumping light within said pump head to achieve effective and efficient uniform pumping; and iii) with

the use of said optical duct means, eliminating hot spot issue caused by directly diode bar pumping for DPSS lasers;

(2) a second multipass formation with the use of optical graded-index or step-index configuration,

(3) a third multipass formation with the use of a noncircular-profile reflector means which has a noncircular cross-section with a convex and closed boundary, wherein i) said laser medium means is a laser rod means which has a lasing axis and a transverse plane perpendicular to said lasing axis, said noncircular cross-section is in said transverse plane, ii) said laser rod is surrounded by a cooling channel, and iii) the maximum dimension inside said noncircular cross-section is at least four-times larger than the diameter of said laser rod means,

(4) a fourth multipass formation with the use of a double-layer reflector means,

(5) a fifth multipass formation with the use of optical spatial filter configuration,

(6) a sixth multipass formation with the use of a reflector means, wherein i) said laser medium means is a laser slab means which has a substantially rectangular cross section with two major surfaces, two minor surfaces, and two opposing end faces which are cut at a Brewster angle or square-cut, ii) said laser slab means is cooled via said two major surfaces only , iii) said diode bar means comprises at least one linear array laser diode bar or 2-D stacked diode bar, iv) each said pump entrance receives said pumping light from one or several said diode bars without fiber coupling, and v) said pump light enters said reflector means and multiply passes through said laser slab means via said two major surfaces,

(7) a seventh multipass formation with the use of a noncircular-profile reflector means which has a noncircular cross-section, wherein i) said laser medium means is a laser slab means which has a substantially rectangular cross section with two major surfaces, two minor surfaces, and two opposing end faces which are cut at a Brewster angle or square-cut, ii) said laser slab means is mounted into a laser slab assembly means without O-rings, preferably via a silicone RTV, in which said laser slab means is sandwiched between two coolant passages via said two major surfaces, iii) the flow direction along said coolant passages is perpendicular to said minor surfaces of said laser slab, and iv) said pump light enters said noncircular-profile reflector means and multiply passes through said laser slab means via said two major surfaces,

(8) an eighth multipass formation with the use of an optical duct means, wherein

a) said laser medium means is a laser slab means which has a substantially rectangular cross section with two major surfaces, two minor surfaces, and two opposing end faces which are cut at a Brewster angle or square-cut,

b) said optical duct means consists of two members of thin planar optical duct at least, each one has two broad surfaces,

c) said laser slab means is sandwiched between said two members of thin planar optical duct via said major surfaces firstly, and then sandwiched between two heat sinks via said two members of thin planar optical duct symmetrically,

d) said optical duct means is optically coupled to two said major surfaces of said laser slab means via its said broad surfaces where said pumping light runs into said laser slab means along zig-zag optical paths,

e) said optical duct means is of high thermal conductivity and thermally in contact with said two heat sink via its said broad surfaces, said laser slab means is conductively cooled via said optical duct means,

f) in order to preserve the TIR interface for the laser zig-zag path within said laser slab means, an approach is selected from the group including: i) said laser slab means has a protective coating, and ii) said optical duct means has a lower refractive index than that of said laser slab means,

g) optionally the end of said thin planar optical duct adjacent to said laser slab means is gold coated but not square-cut in order to change the incident angle of said pumping light for effective pumping,

h) optionally said heat sink has a mirrored surface which is interfaced with said broad surfaces of said thin planar optical duct whereby to reflect said pumping light and realize multipass pumping,

i) optionally part of the additional members of optical duct have a tapered shape, and

j) optionally lateral sides of said optical duct have a gold coating in order to reflect said pumping light while said optical duct means has a low refractive index,

(9) a ninth multipass formation with the use of an optical duct means, wherein

a) said laser medium means is a laser slab means which has a substantially rectangular cross section with two major surfaces, two minor surfaces, and two opposing end faces which are cut at a Brewster angle or square-cut,

b) one said major surface of said laser slab means is interfaced with said optical duct means, the other one of said major surfaces is conductively cooled,

c) said pumping light, once entering said optical duct means, will undergo zig-zag optical paths, multiple reflections and multiple travels through said laser slab means until it is absorbed;

d) said pumping light enters said laser slab means via its major surface,

e) for the cooling side of said slab means, in order to reflect pumping light and to preserve the TIR interface for the laser zig-zag path within said laser slab means, an approach is selected from the group including: i) it is covered by a metal foil which may have a high reflectivity, ii) it is interfaced with a metalized mirror surface of a heat sink, and iii) it is HR coated at the pump wavelength, and the SiO_2 or MgF_2 material is used as the first layer of the HR coating,

f) for the non-cooling side of said slab means, in order to preserve the TIR interface for the laser zig-zag path within said laser slab means, an approach is selected from the group including: i) it has a protective

coating or bonding material, ii) it has a MgF_2 window, iii) said optical duct has a lower refractive index than said slab means, and iv) it is distanced from said optical duct means with an interstitial air,

g) optionally one side of said optical duct has a gold coating in order to reflect said pumping light, and

h) optionally part of said optical duct means have a tapered shape, and

(10) a tenth multipass formation with the use of a reflector means, wherein i) said laser medium means is an optical fiber means with a rare-earth-doped core, ii) said diode bar means comprises at least one linear array laser diode bar or 2-D stacked diode bar, iii) said pumping light from one or several said diode bars are optically coupled to one said pump entrance, and iv) said pump light enters said reflector means and multiply passes through said optical fiber means; and

E. housing and cooling said laser medium means.